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We bring innovation to transportation.

Virginia Quiet Pavement Study ***(Fall 2012 Update)***

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Fall Asphalt Conference
Richmond, VA

Quiet Pavement Technologies (2011)

Asphalt:

- Open-graded with 9.5mm top-size stone and rubberized AC (AR-PFC 9.5)/1-inch
- Open-graded with 9.5mm top-size stone and polymer-mod. AC (PFC 9.5)/1-inch
- Open-graded with 12.5mm top-size stone and polymer-mod. AC (PFC 12.5)/2-inch

Concrete:

- Conventional Diamond Grind (CDG)
- Next Generation Conc. Surf. (NGCS)

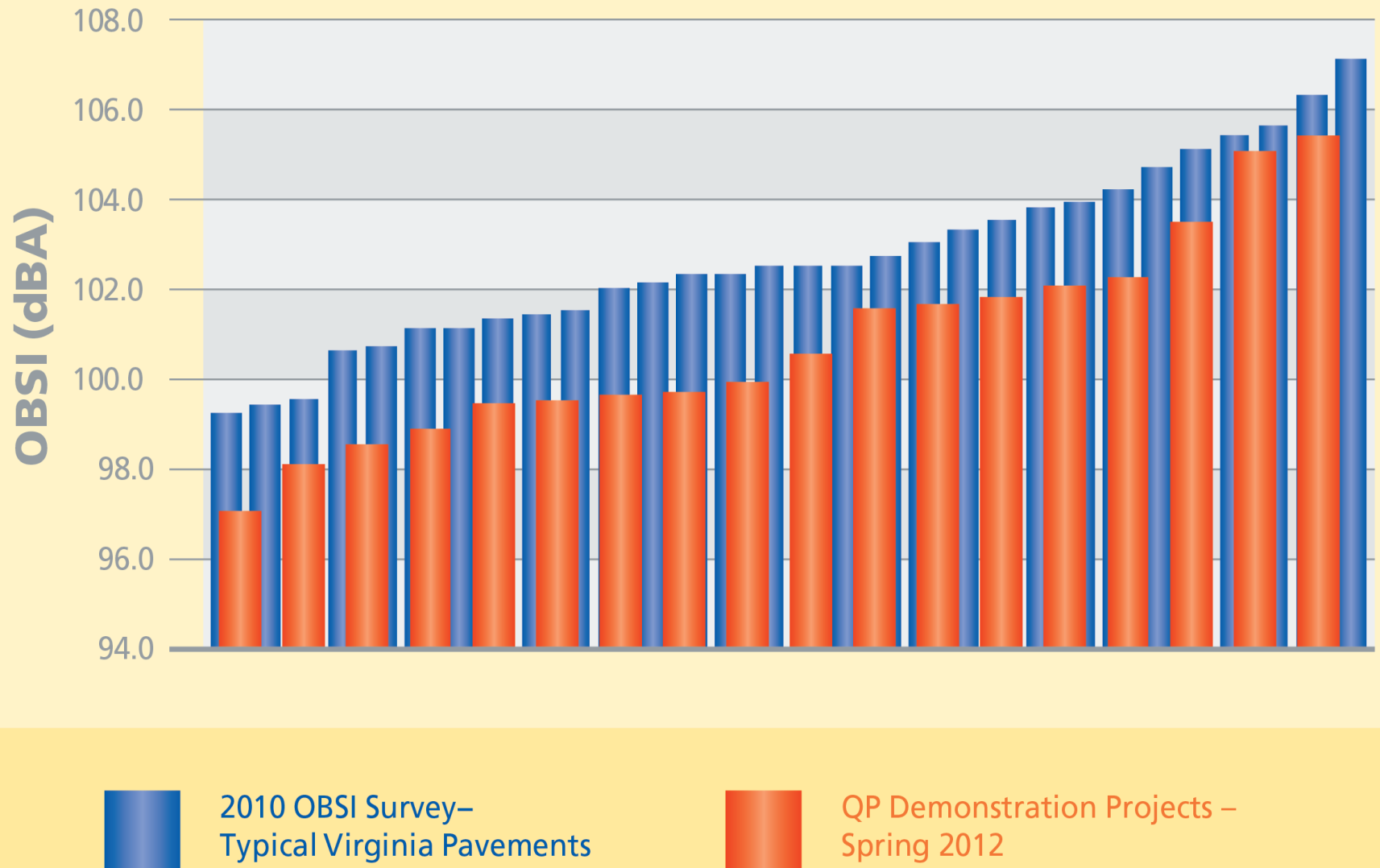


Noise Measurement

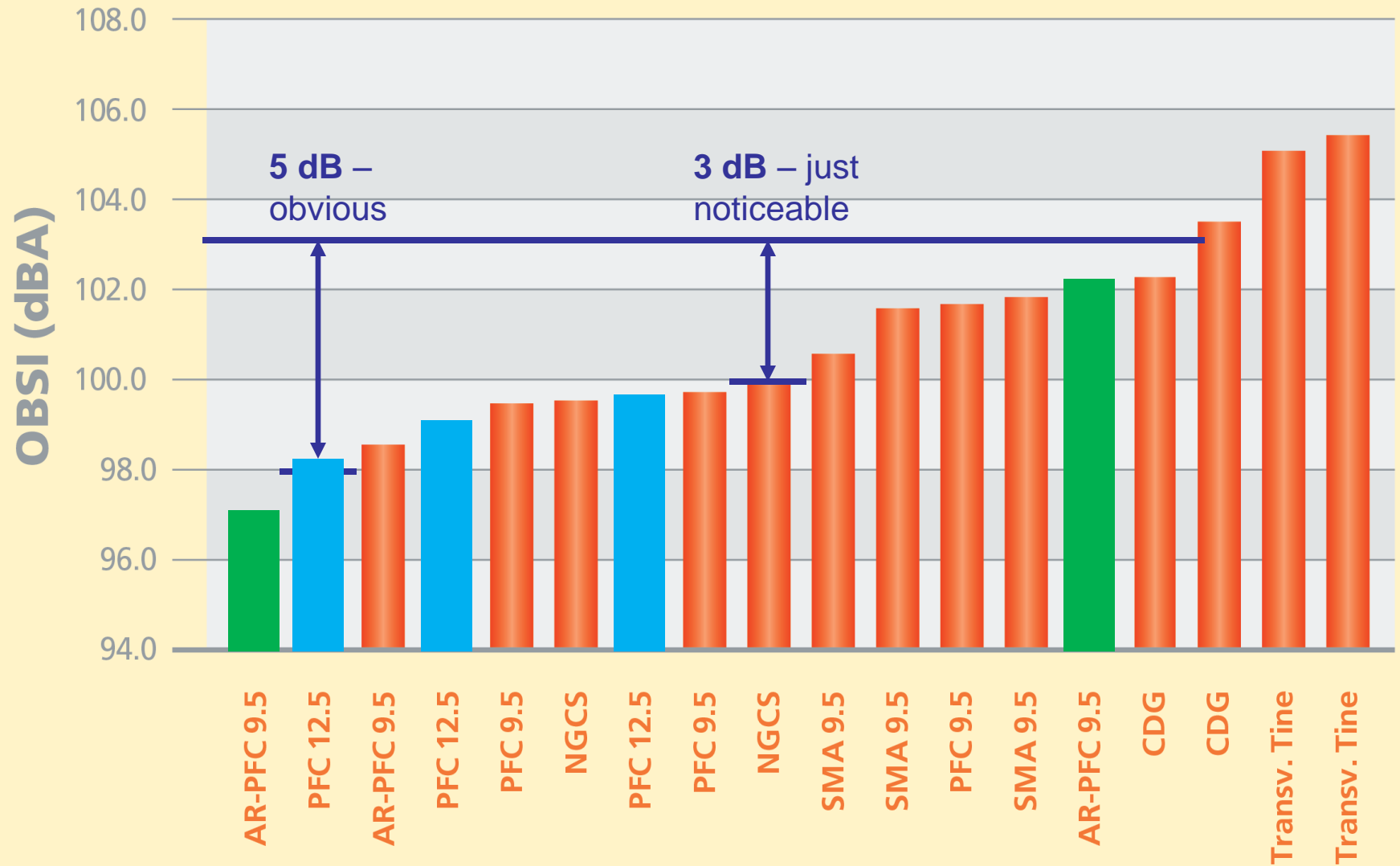
Tire-Pavement (i.e. OBSI)



Typical Virginia Pavements vs. QP Demonstration Projects



QP Demonstration Projects – Spring 2012



Tire-Pavement Friction

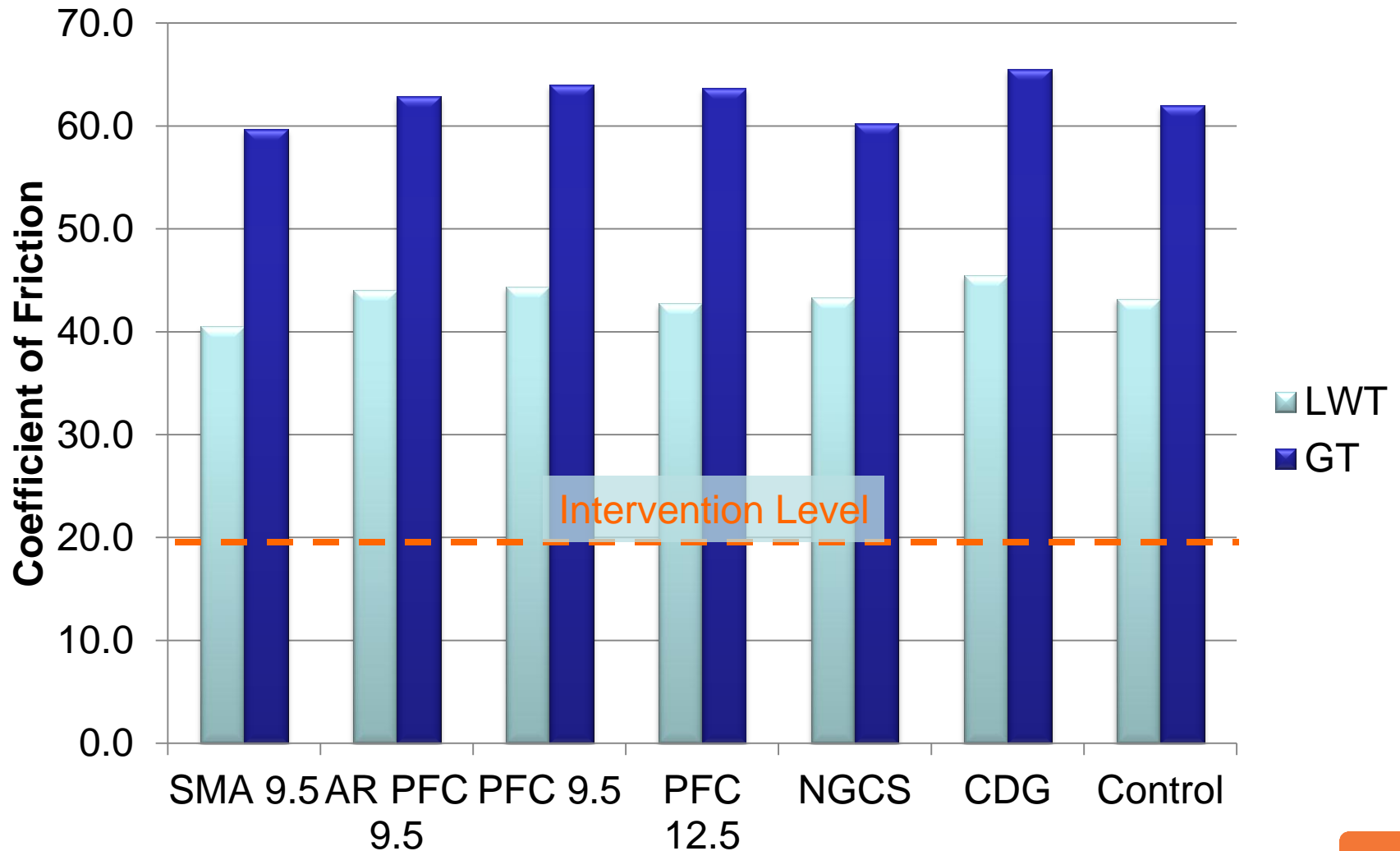
Locked-Wheel
System (LWT)



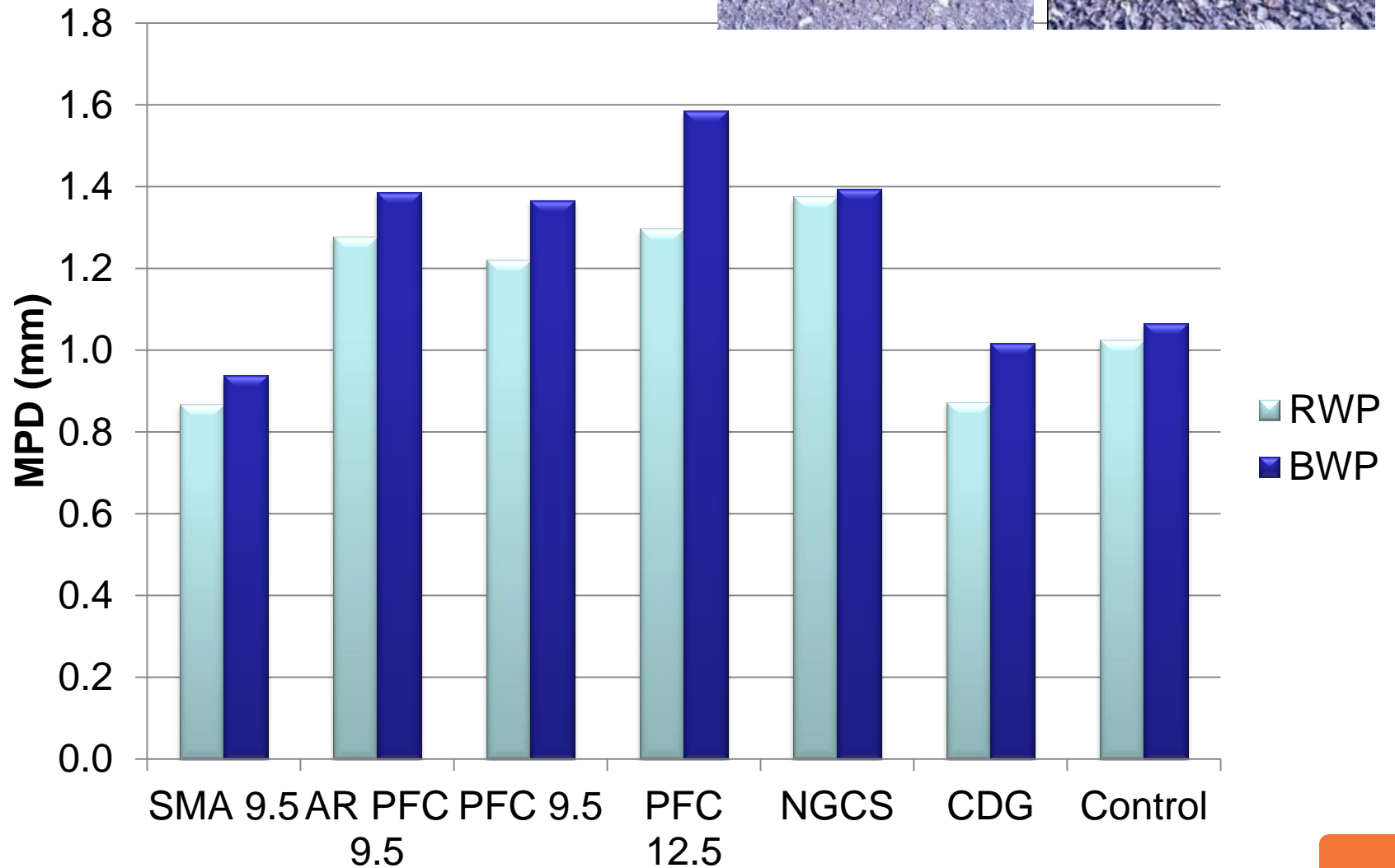
GripTester (GT)



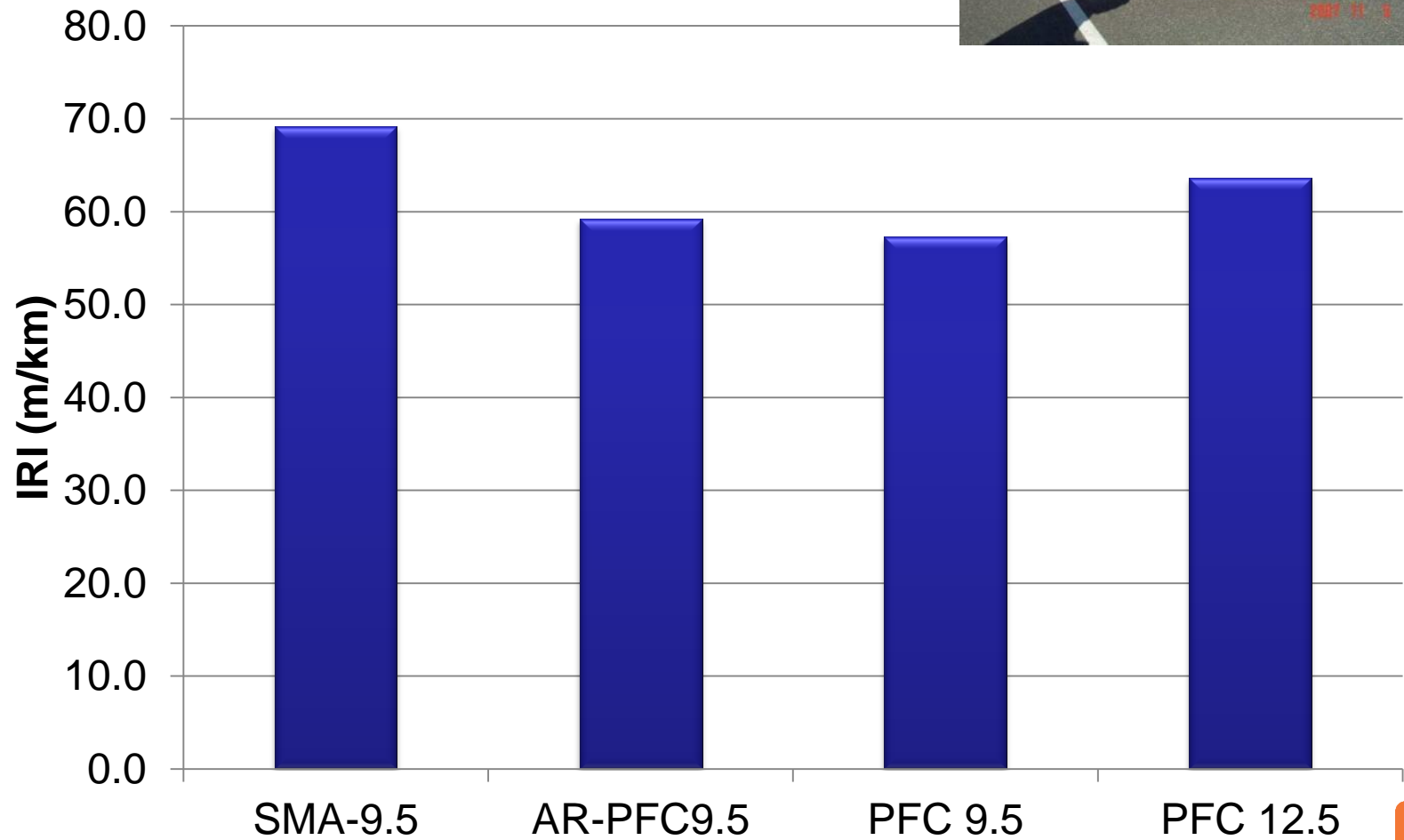
Tire-Pavement Friction



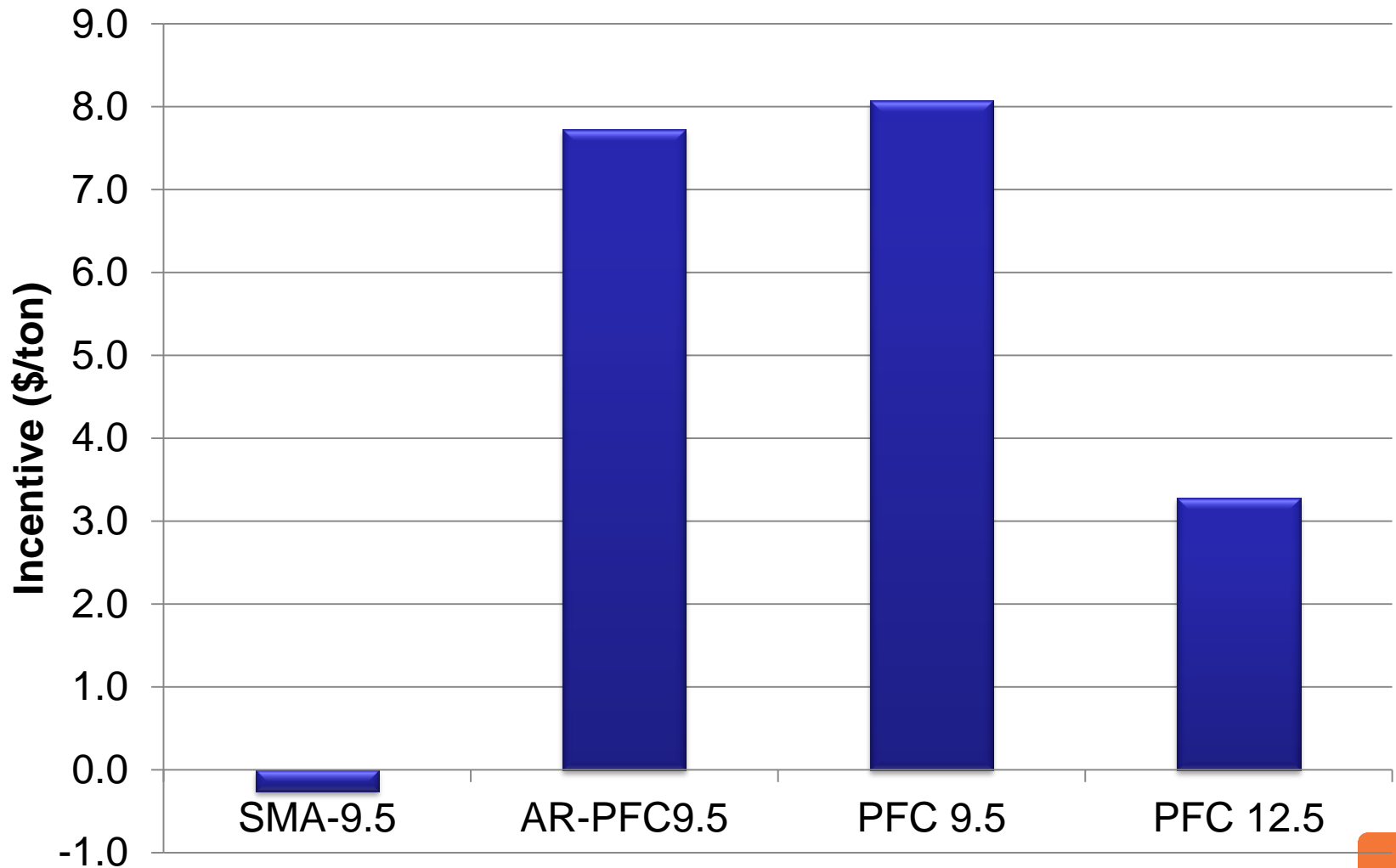
Macrotexture



Ride Quality



Pay Adjustment for Smoothness



Summary – 2011 Demos

- QP technologies (asphalt) *measurably* less noisy than control, but on average not *noticeably* ($\geq 3\text{dB}$)
- QP Technologies exhibit excellent ride quality and skid resistance
- The QP technologies have reduced splash and spray with improved wet-weather visibility (word of mouth)
- There were no reports of compromised safety during winter weather with QP





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For more information:

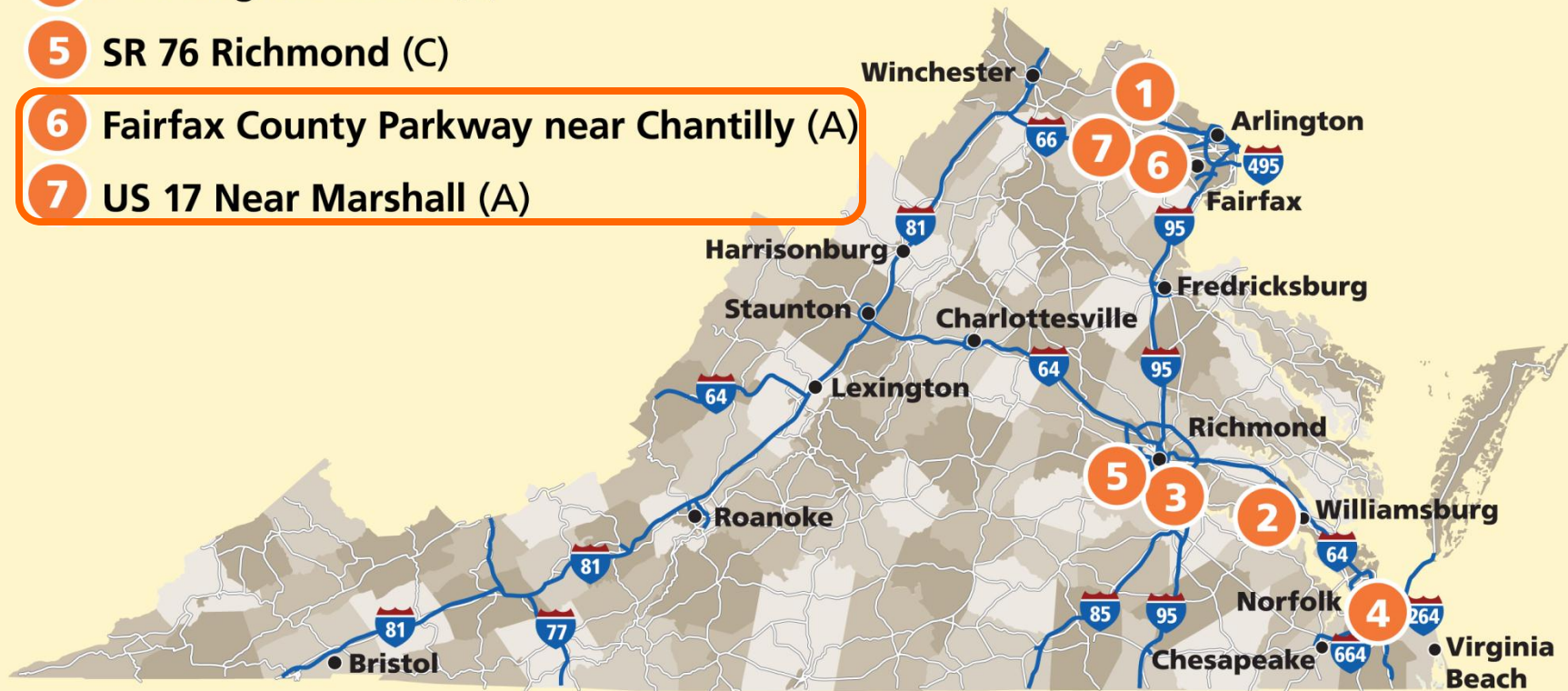
Kevin.McGhee@vdot.virginia.gov

Links to Interim Report:

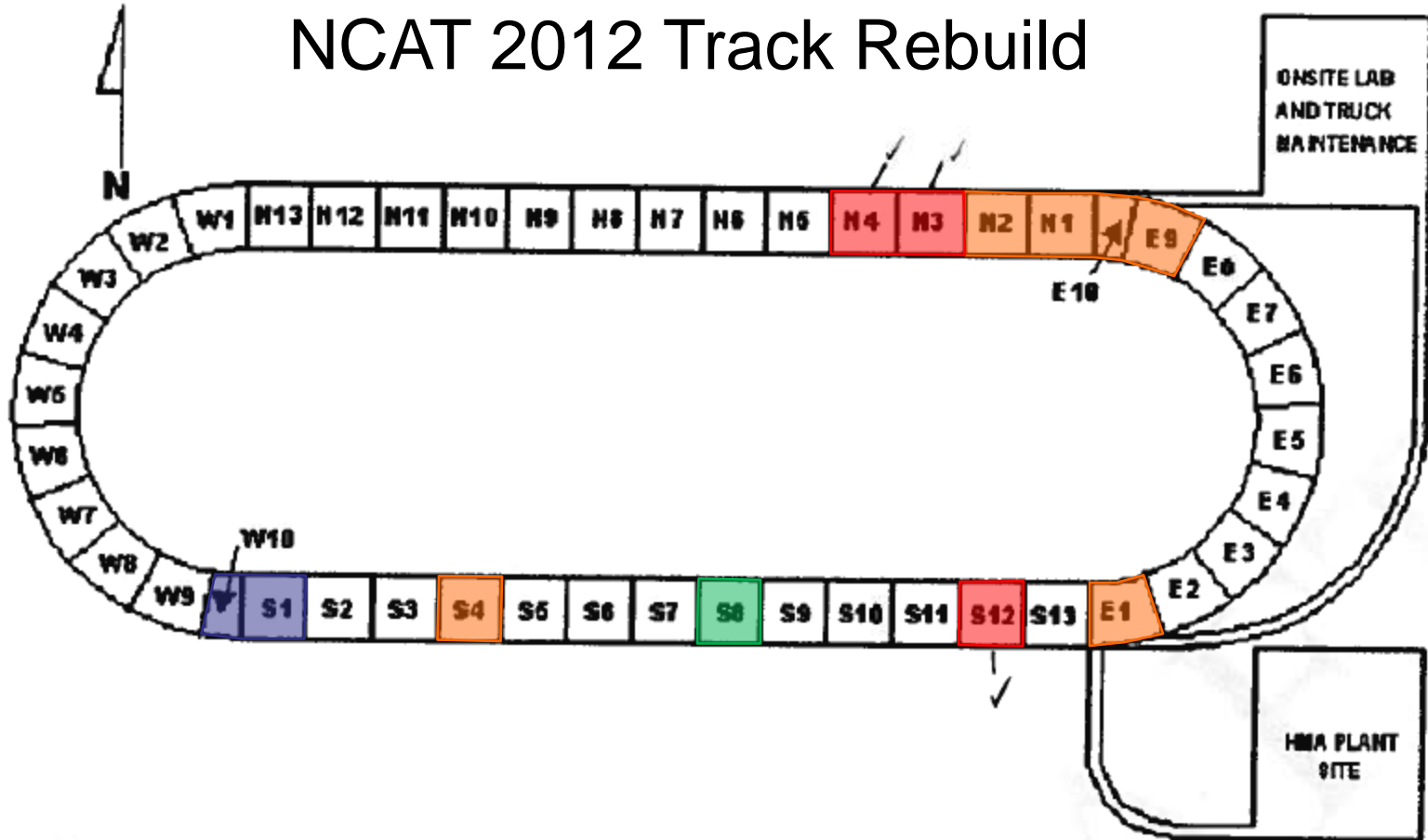
http://www.virginiadot.org/VDOT/Projects/asset_upload_file884_5721.pdf

Demonstration Projects 2011/12


- 1 SR 7 By-Pass in Leesburg (A)
- 2 SR199 west of Williamsburg (A)
- 3 SR 288 near Chester (A)
- 4 I-64 Virginia Beach (C)
- 5 SR 76 Richmond (C)
- 6 Fairfax County Parkway near Chantilly (A)
- 7 US 17 Near Marshall (A)



NCAT 2012 Track Rebuild



 - 2012 Virginia PFC

 - 2012 Other PFC

 - 2009 Other PFC

 - 2012 Virginia SMA/DGA/Recycle



QP Use Strategy (the LCA)



- Cost components:
 - QP technology as substitute for noise barriers?
 - “Acoustic longevity” – QP replacement cycle?
 - Additional maintenance costs – winter and periodic cleaning/vacuuming
- Value of benefits (?):
 - lower noise
 - improved safety & comfort
 - Reduced rolling resistance

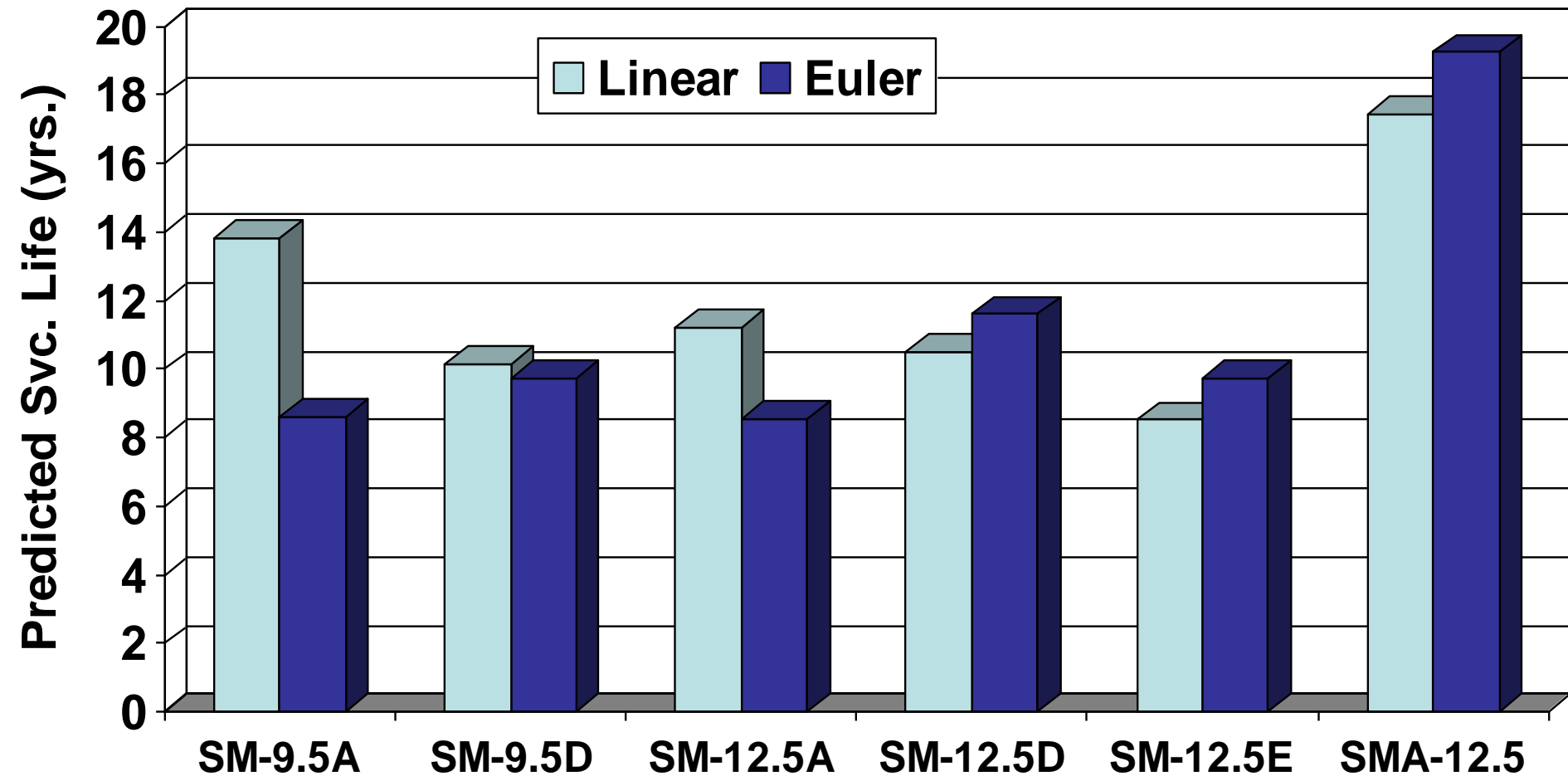




SMA Research Update

- Phase 1 – Network Performance Review
 - 10 years full-scale production
- Phase 2 – Material & Lab Analysis
 - “Underperforming” SMA 9.5 mixes/applications

Phase 1 - Service Life Models



Field Review 2011 - Summary


Mix Category	Observed Distress Types		
	Reviewed	Material	Structural
SMA 9.5(70-22)	8	5	1
SMA 9.5(76-22)	4	2	2
SMA 12.5 (70-22)	14	1	6
SMA 12.5(76-22)	2	1	1
Totals*	28	9	10

*Includes RAP and Virgin Mixes





SMA-9.5 (Flushing, Shoving, and...)



SMA-9.5 (...Rutting)

Phase 2 – Material & Lab

- **Design issues**

- “Unpredictable” performance of the finer SMA (SMA 9.5) mixes.
- Both successful and not-so-successful in compliance (mostly) with design requirements.

- **Application issues**

- SMA mixes are performing well on high-volume facilities with signalized intersections but localized mixed failures have been observed at locations with high turning and stopping movements.



Phase 2 - What we did

- Identify mixtures with known performance (good, bad, and marginal)
- Fabricate “reproduction” mixtures
- Conduct aggregate gradation analysis
- Conduct lab performance tests
 - Dynamic modulus (to evaluate stiffness)
 - Flow number (rutting susceptibility)
 - Indirect tensile strength
 - Asphalt pavement analyzer (rutting?)



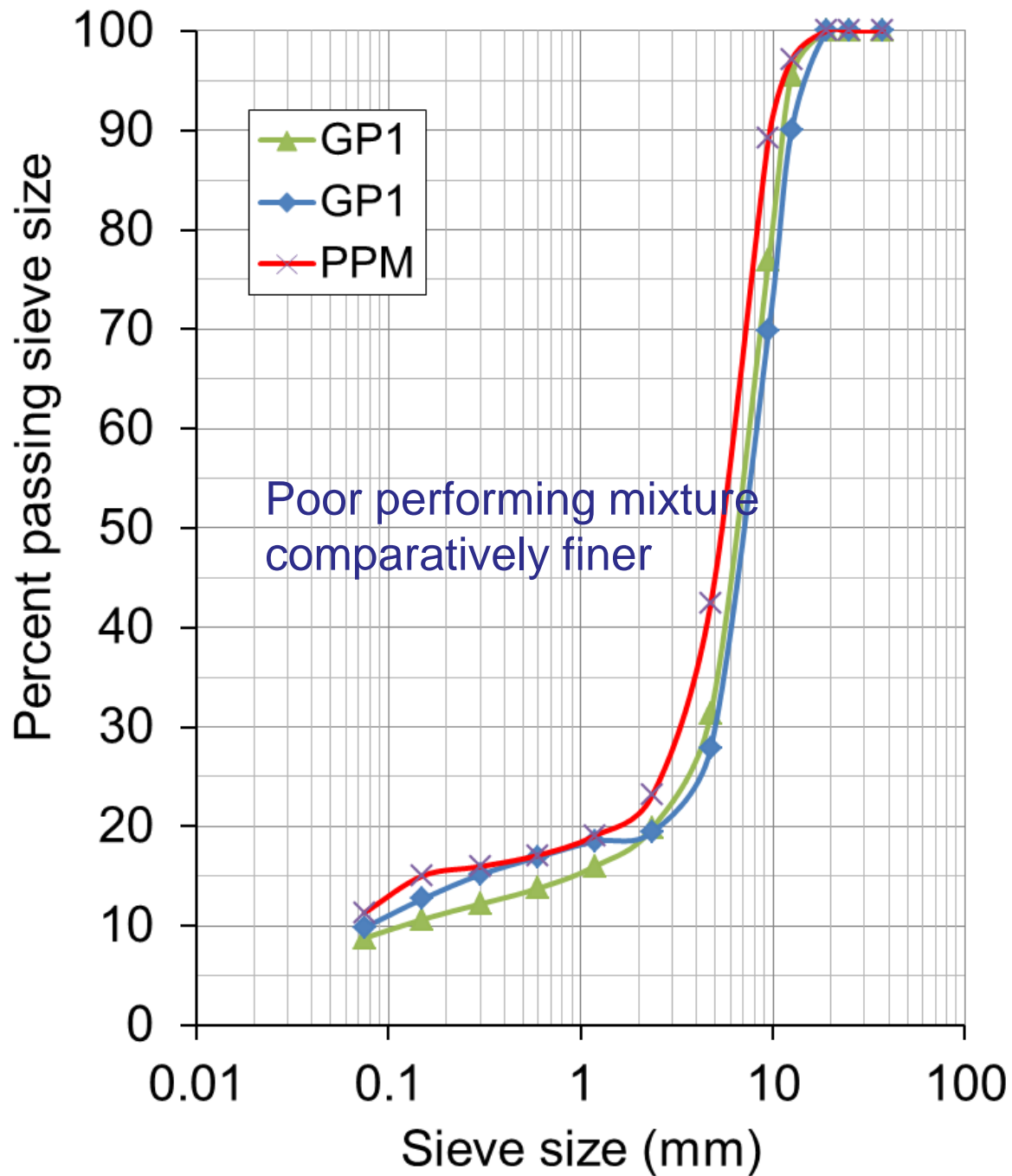
Mixture details

Mix ID	% P _{be}	Fiber, % by wt of AC	% passing No. 4	Field Performance
GPM1	6.5	4.6	27.9	Good
GPM2	6.3	5.5	31.3	Good
MPM	6.3	5.5	29.5	Mixed
PPM	7.2	4.0	42.4	Poor

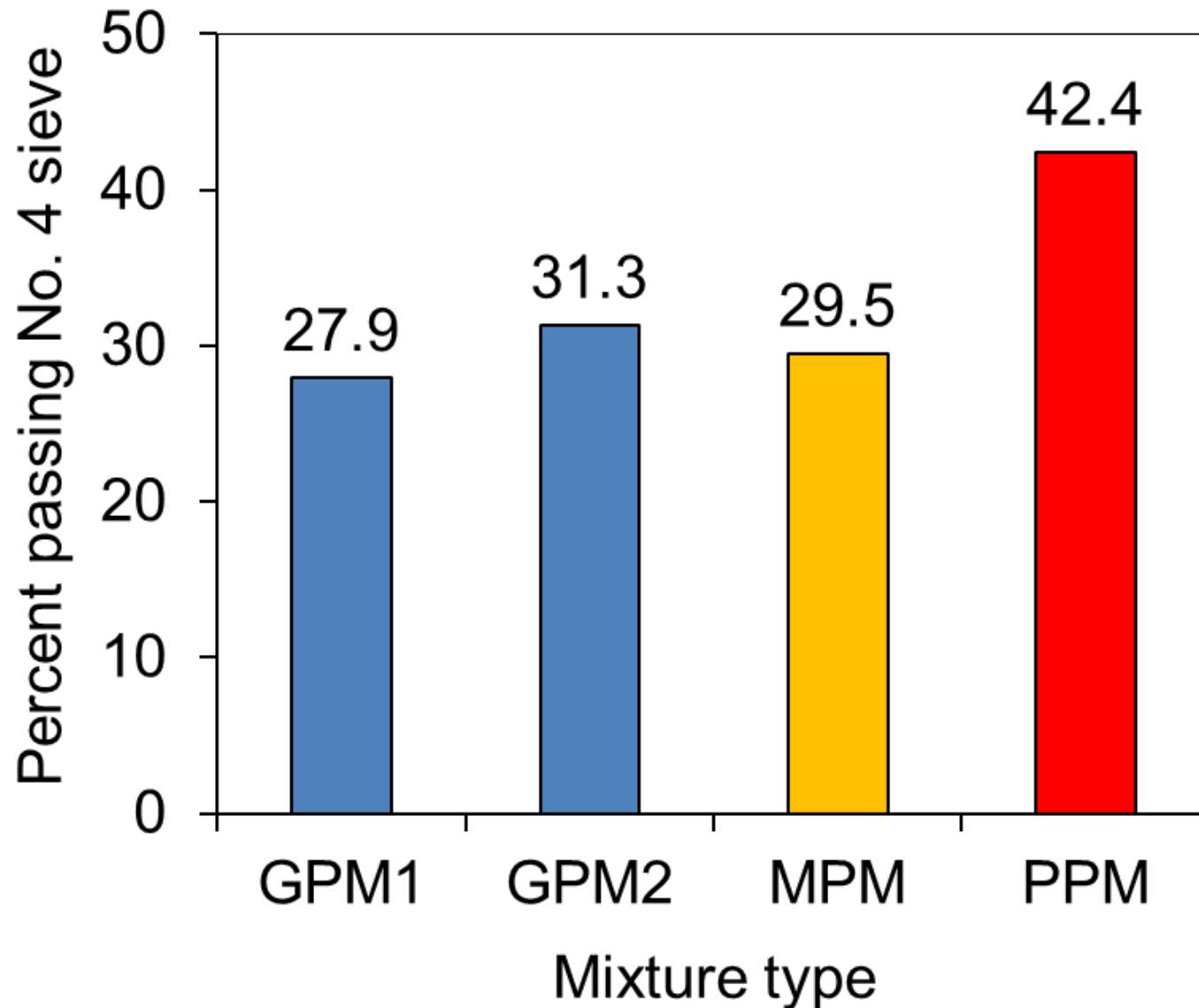
*Note: original plant mixtures except GPM1 had anti-strip but the lab mixes did not have them. GPM 1 had 1% lime. All 'D' mixes used PG 70-22 binder. MPM had 15% RAP.



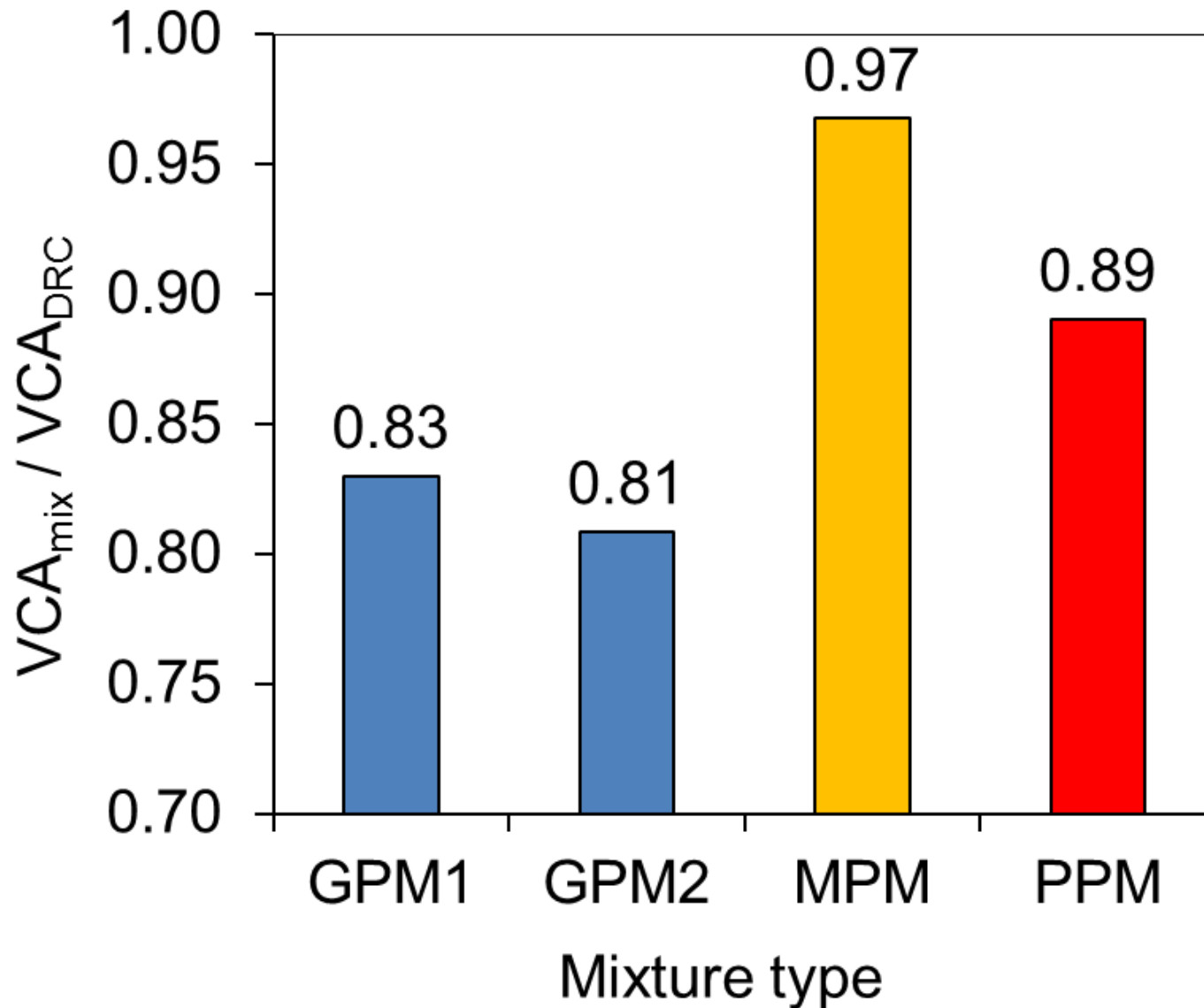
Gradation



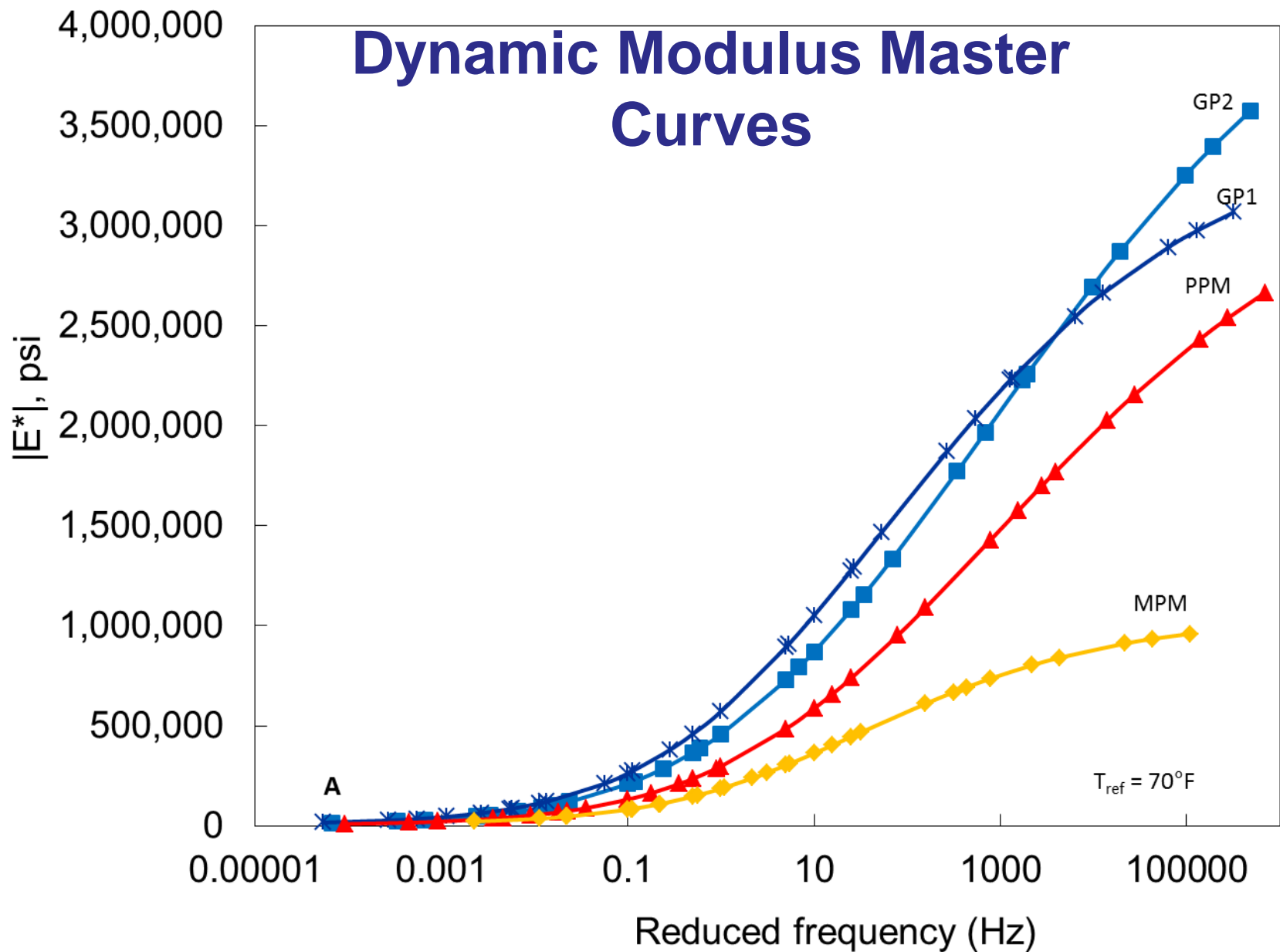
Stone-on- stone contact: PPM has least



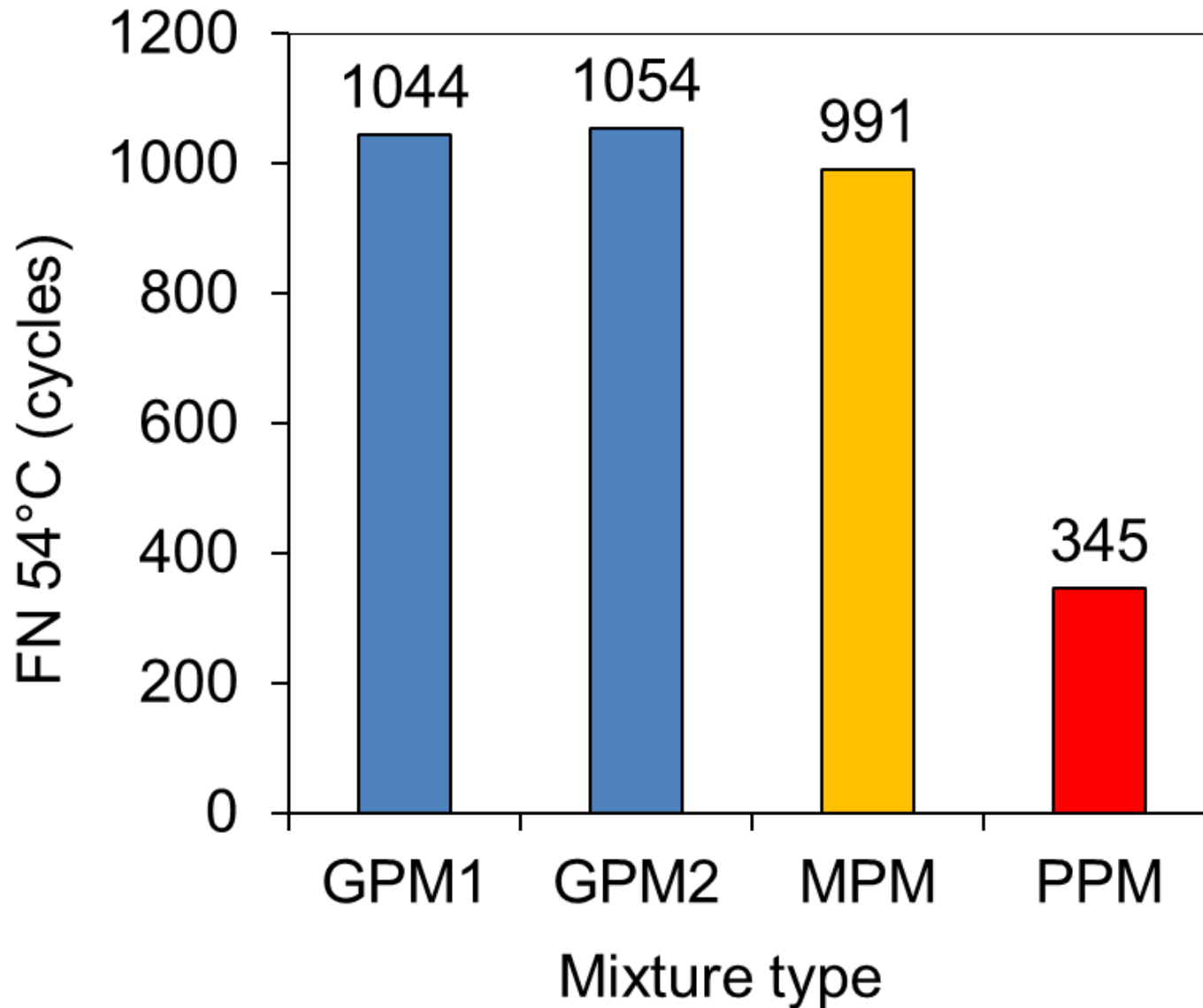
Stone-on-stone contact: VCA



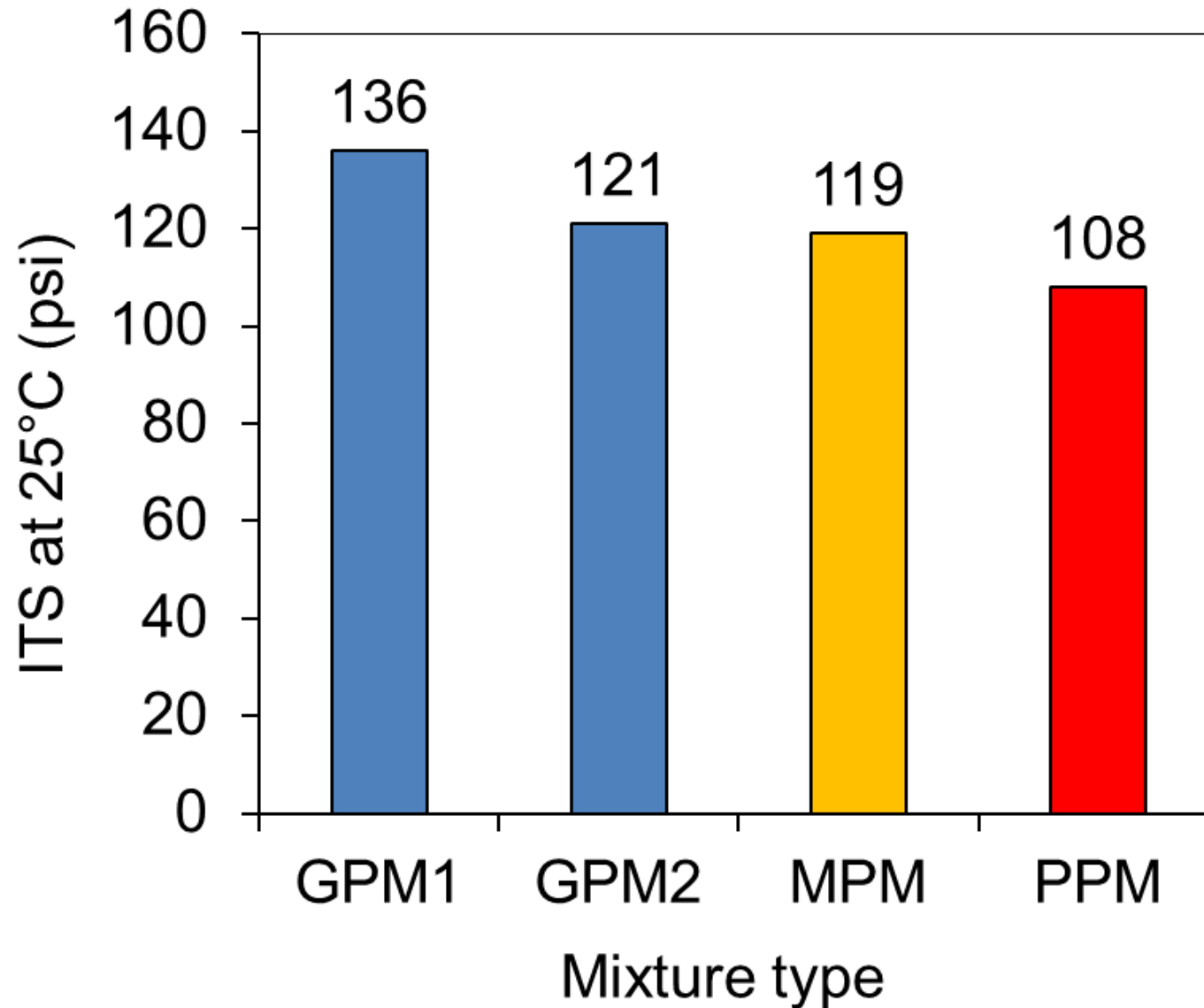
Dynamic Modulus Master Curves



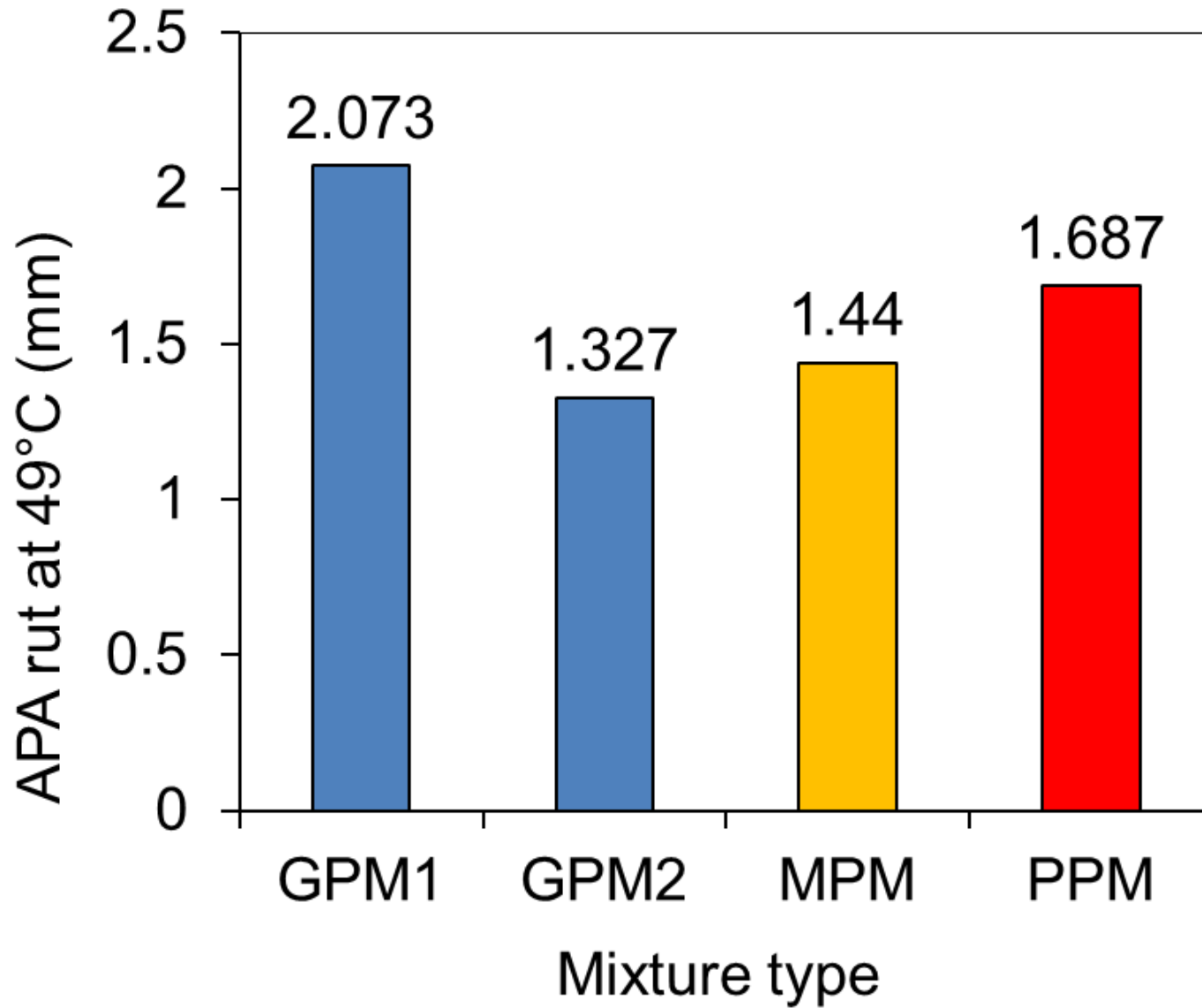
Flow Number at 54°C



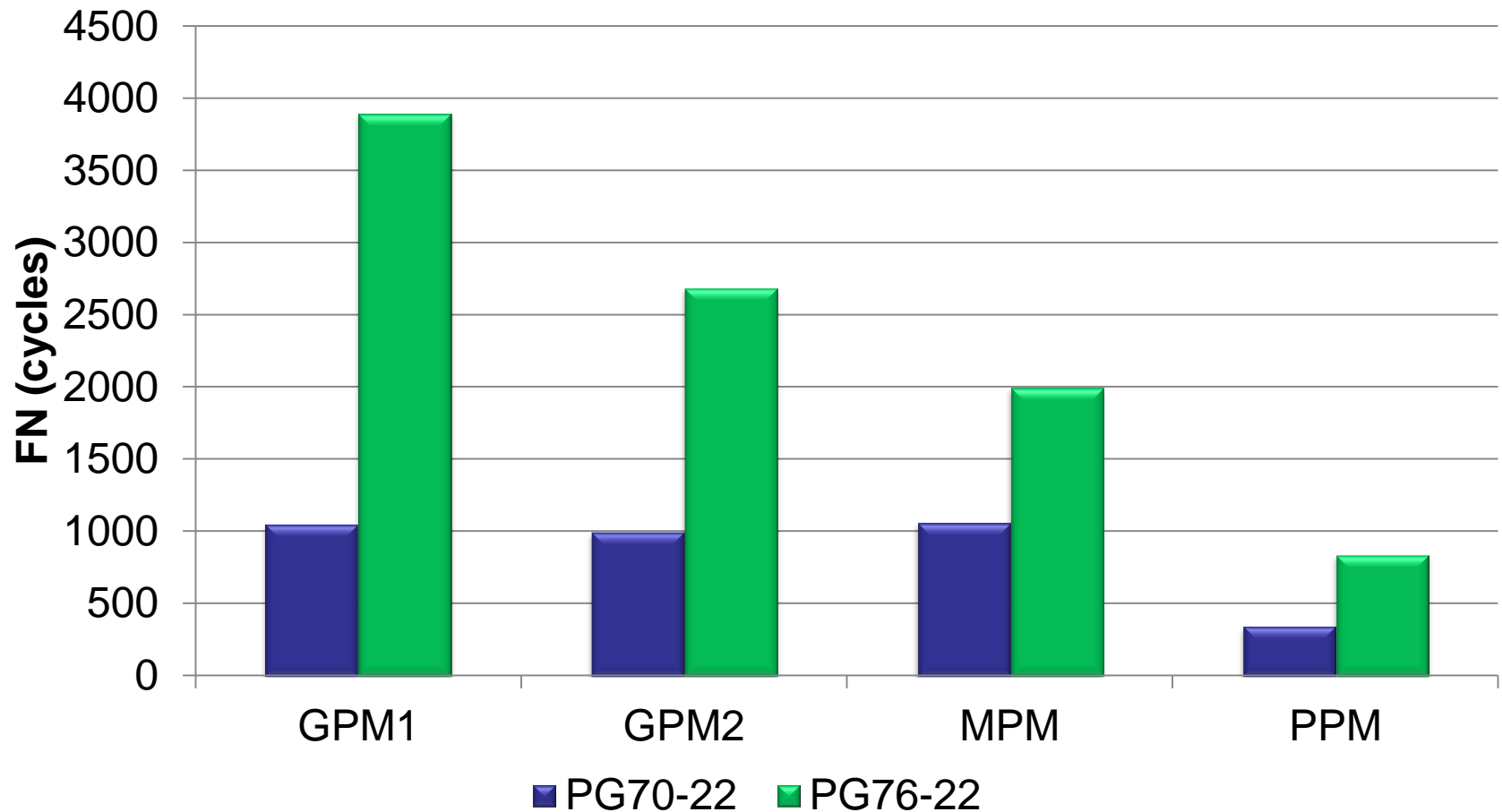
Indirect tensile strength



APA rut



Flow Number – Polymer Modification



Conclusions

- Good performing SMA mixtures obeying the “30-20-10” rule performed better in terms of $|E^*|$, FN, and ITS tests. Ranking of mixtures based on these performance tests compared quite well with field performance. Therefore, these tests could be useful for evaluating SMA performance.
- SMA mixtures with good field performance were associated with comparatively better aggregate packing characteristics. The measured VCA_{mix} for the good performing mixtures ranged from 33.7 to 35.9 percent compared with 38.2 to 41.9 for the poor performing mixtures.



Conclusions (II)

- The APA was found **not** to be sensitive to either binder content or aggregate packing characteristics for the mixtures considered. Therefore, care needs to be taken when using the APA to evaluate SMA performance in the lab.
- A combination of traffic characteristics (slow-moving, turning, or stopped), poor aggregate packing (higher VCA_{mix} , higher percent passing No. 4 sieve), and binder amount, may have contributed to the poor SMA field performance.



Bottom Line

- MPM and PPM no longer produced
- Recent changes to SMA spec – gradation band changes and break-point sieve – supported by field and laboratory work
- New SMA 9.5 mixes are in production and “looking good”
- We’ll take credit for it in the VCTIR final report – early 2013☺

